ULTURAL
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U.S. DEPARTMENT OF AGRICULTURE

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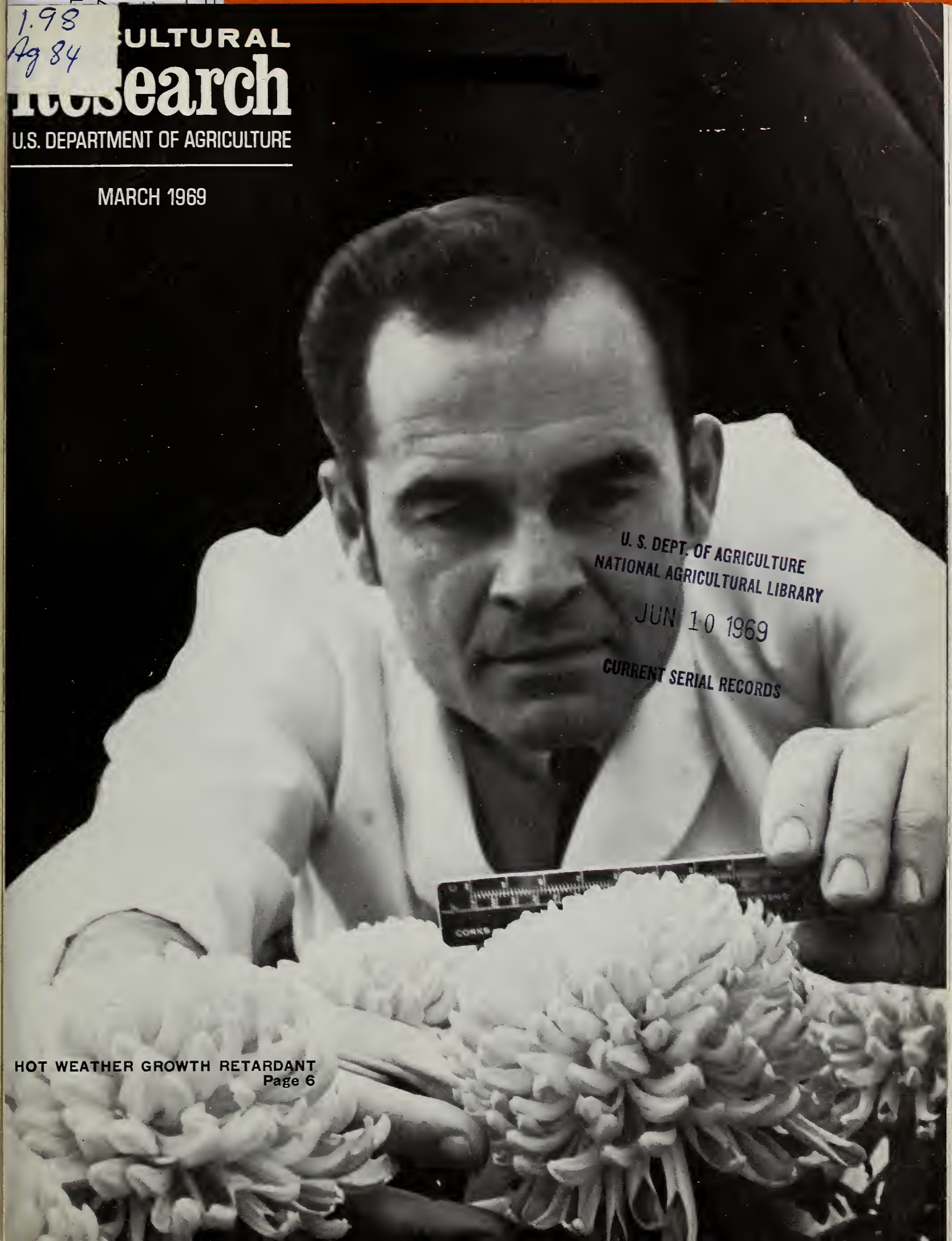

HOT WEATHER GROWTH RETARDANT
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AGRICULTURAL
Research

March 1969/Vol. 17, No. 9

A Better Place to Live

The pleasure and benefits that people find in well-kept lawns and flower, fruit, and vegetable gardens will be emphasized during National Lawn and Garden Week.

USDA joins industry and civic groups in sponsoring this observance, which runs March 20–26, to interest more Americans in gardening as part of an effort to make our surroundings more attractive.

Planting and caring for growing things provide tangible benefits such as enhanced property values and healthful exercise. And an "outdoor living room" can be a balm for tired eyes and frayed nerves. Indeed, the most important benefits of gardening may be those of the spirit.

Today, however, many people in our increasingly urbanized society have lost contact with the land. For them, entry into the green world offers a chance to respond to the rhythms of the seasons and to become aware of the complexities in nature's living patterns. And those who tend a plot of ground—be it large or small—often develop a sense of trusteeship for the natural world and its resources.

The plantlife and landscapes that render our environment more livable reflect the work of many ARS scientists. They and other scientists are providing improved varieties, cultural practices, and disease and pest control methods. And they are rapidly disseminating their findings through clinics for national leaders in the nursery and florist business. Future research will certainly outstrip the achievements of the past.

But the mission of science is to shed light on problems—it takes people to put research to work. Knowledge must be followed by choice and action. Whether a community is in harmony with nature largely depends on the concern and activities of the people who live there. In our affluent and highly technological society we have unprecedented power to make or mar tomorrow's landscape. The direction is ours to choose.

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Clifford M. Hardin, Secretary
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from seed to flower, fast . . . in controlled environments

Krizek compares the growth of two petunia plants both 17 days old. The one in his hand was grown under greenhouse conditions; the other, in the growth chamber (ST–4469–15).

PHENOMENAL PLANT YIELDS, 10 to 50 times above normal (dry weight), have been achieved with improved cultural techniques and controlled environments developed by a team of ARS researchers.

Several other growers and researchers have stimulated plant growth 2- to 3-fold by varying the individual environmental factors of light intensity and duration, temperature, humidity, carbon dioxide concentration, air velocity, and nutrient levels. But the research team at Beltsville, Md., is the first to combine all of these factors in specially-designed growth chambers.

The researchers, plant physiologist D. T. Krizek and agricultural engineers H. H. Klueter and W. A. Bailey, obtained striking results with both vegetable and ornamental plants. The plants not only grew faster than those grown conventionally, but they were sturdier and had more branches and flower buds.

In addition to accelerated plant growth and development, the new system enables precise scheduling of seedling production. And labor cost can be reduced because of the shorter growing times

Above: *Bailey checks a chart on the data logging machine used extensively in the Phyto-Engineering Laboratory, which houses the growth chambers (ST–3241–4).* **Below:** *Two petunia plants both 5 weeks old. Plant on right was seeded and grown in controlled environment for 18 days, then moved to the greenhouse. Plant on left was grown from seed in the greenhouse (PN–1760).*

required by plants in the chambers.

The system departs from standard growing practices in several ways. In conventional methods seeds are mass-planted in flats, then transplanted once or twice. This means extra work and causes plant shock that retards growth. In the new technique, seeds are planted directly in an artificial soil mix and barely covered. The seedlings are never transplanted, only thinned. The root systems are undisturbed. Result . . . less work, and shock is eliminated.

Key points in the new technique are starting the treatment very early—at the time of seeding or when the seedlings are no more than 4 to 10 days old—and then elevating and strictly controlling environmental factors.

For test purposes, natural daylight (about 12 hours), carbon dioxide level of about 300 parts per million, day temperatures of 75° F., and night temperatures of about 65° F. were considered to be conventional greenhouse environmental conditions.

The research team used higher temperatures, 85° F. day and 75° F. night, and light was maintained as high as 4,000 foot candles using cool-white fluorescent supplemented by incandescent lighting for at least 16 hours a day. Humidity was held at a minimum of 65 percent and the carbon dioxide content of air was enriched to as much as 2,000 parts per million. The air was continually moved at 35 to 40 feet per minute, and a nutrient solution was applied every 4 to 6 hours. Under these conditions, plant yields (dry weight) were 1,000 to 5,000 percent greater than those of plants conventionally grown.

The scientific team is continuing research to extend these practices to other species of plants, since each one reacts differently to treatment combinations. The growth chamber studies will help establish recommendations for optimum environments for the plant species tested.■

PLANT GROWTH CHAMBERS
for Engineered Environments

PRECISION-CONTROLLED environments are helping ARS researchers write the specifications for optimum plant growth.

Designed to regulate almost every environmental factor influencing plant development, the growth chambers at Beltsville, Md., are monitored and controlled by ARS agricultural engineers H. H. Klueter and W. A. Bailey. They are working with plant physiologist D. T. Krizek.

The chambers are constructed of clear plexiglass, which makes it easier to conduct and observe experiments and to apply light from outside the chamber for better temperature control. Fluorescent lamps regulated by a 24-hour time clock supply light for the plants. As the individual lamps age, current is increased to compensate for the loss of light output.

To provide separate day and night conditions without resetting, the researchers modified a commercially manufactured temperature-humidity control system. Before modification, the apparatus could be set at only one temperature and one humidity reading.

Particularly significant in the chamber design is the maintenance of carbon dioxide at desired levels through the use of a modified carbon dioxide infrared analyzer. Air is pulled from the chamber through a small plastic tube to a three-way solenoid valve. Every 2½ minutes the valve switches, sending the air through the analyzer, which reads the level and records it. When carbon dioxide falls below the desired level, another valve is activated by the analyzer to turn carbon dioxide into the system.

Two other growth factors, water and fertilizer, are automatically regulated through a series of time clocks. Small plastic hoses attached to a tank outside the chamber supply the individual plants.

Velocity of air, important in carrying away heat generated by the lamps but not enough to whip the leaves or cause excessive drying, is controlled by the size and speed of the fan returning air to the chamber.

Most of the engineering data are monitored by appropriate sensors. The data from these sensors are sent to an automatic data-recording system where they are logged on tape. With the system programmed, the scientists can run the tape through a computer and analyze as much or as little of the data as they care to.

And the agricultural engineers say modified chambers can be built to almost any size. They can be small reach-in boxes with only a few lamps and used to germinate seeds or increase seedling growth, or large walk-in growth rooms for growing large plants or trees. They could also form a series of elaborately controlled growth rooms, each several hundred square feet in size and located under one roof.■

Left: *Klueter (right) measures and Bailey records the light level in the growth chamber (ST–4469–3).* **Right:** *They check out the system that automatically monitors and controls at preset levels the carbon dioxide content (ST–4468–7).*

Cover: *Cathey checks blooms of treated mums (ST–4499–25).* **Right:** *UNI F529 is applied to a poinsettia. The other two plants are the same age but the one on the left was treated (ST–4467–1).* **Below:** *Varying dose of retardant produced different heights in mums of same age (ST–4467–8).*

Hot weather no hindrance to new growth retardant

A NEW CHEMICAL growth retardant promises gardeners and commercial growers a safe, economical, and effective means of year-round plant growth control.

Comparison tests by ARS horticulturist H. M. Cathey show the new retardant, UNI F529 (N-pyrrolidinosuccinamic acid) to be superior to more than 100 other retardants, and it is effective on a wider range of plants. It is also less toxic to plants.

In addition, the new retardant works well at all growing temperatures and, because of its improved persistence, performs much better at higher temperatures. This is a major consideration for commercial growers who have experienced the most difficulty with other growth retardants during periods when temperatures exceed 70° F. The effects of other retardants do not persist, making repeated applications necessary to maintain the desired height control.

Growth retardants are used to reduce stem growth of ornamentals, producing desired heights ranging from less than half to about three-quarters as tall as untreated plants. Retardants affect only the heights of plants; bloom and leaf sizes don't change.

Shorter-stemmed plants are better proportioned; therefore, they are less susceptible to toppling caused by large blooms that make plants top-heavy. The flowers last longer, and treated plants have shown some tendency toward increased resistance to air and water pollution, freezing, and water loss as well.

In a series of tests, Cathey compared UNI F529 with B995 (succinic acid 2,2-dimethylhydrazide), one of the most widely-used chemicals and a member of the same family of growth retardants. He sprayed 19 ornamental species with the chemicals in 0.25, 0.5, and 1.0 percent solutions.

Retardant action of UNI F529 was equal to B995 in 14 species, but it produced far better results than B995 when sprayed on chrysanthemum, coleus, marigold, poinsettia, petunia, and tomato.

The new growth retardant achieved results with about half the dosage required by B995. And only one application was needed, compared to several applications for B995.

The experiments showed that UNI F529 was most effective when applied as a spray rather than as a drench or soil amendment. It should be applied to plants in the early growth stage, before budding, in a water spray sufficient to cover plant foliage with a glistering liquid film.

Concentrations of the chemical in spray solutions can range from 0.125 to 1.0 percent, depending on the plant being treated and the degree of growth-retarding action desired.

In continued experiments, Cathey is expanding his research to include a broader range of species.■

Aluminum foils aphids
. . . and doubles yields

APHID-REPELLING strips of aluminum foil more than double yields of vegetables and improve the quality of gladiolus flowers.

Flying aphids often transmit virus diseases that reduce crop yields. Insecticides do not kill disease-bearing aphids rapidly enough to prevent infection. But even though surrounded by disease-bearing plants and aphids, the foil strips provide an effective barrier by reflecting ultraviolet rays from the sky. This causes the flying insects to change their course.

Trapping tests conducted as a check produced results that correlated with the use of aluminum. Traps on protected plots captured 90 to 98 percent fewer aphids than did traps on unprotected plots.

In earlier tests, foil strips appeared promising when mounted on stakes around the plants (AGR. RES. June 1964, p. 5). Recently, however, ARS entomologist F. F. Smith and plant pathologist R. E. Webb at Beltsville, Md., obtained equally good results by eliminating the stakes and placing the foil strips directly on the ground—where they also served as a water-and-fertilizer-conserving mulch. The strips also kept the soil cooler so roots grew better.

Smith and Webb reported that during the first 6 weeks after planting squash, virus infections in foil-protected plots spread to only 11 percent of the plants, compared to 98 percent of the squash in unprotected plots. This early-season protection increased yields dramatically in foiled plots, even though infections later in the season approached those of plants in unprotected plots.

In the tests, the scientists harvested 8,100 pounds of squash per acre in foiled plots; unprotected plots yielded about 1,500 pounds of squash per acre.

Foiled plots produced larger as well as a greater number of squash. For example, at Farmingdale, N.Y., ARS entomologist G. V. Johnson and Cornell floriculturist Arthur Bing harvested 719 squash weighing 461 pounds from plots protected by aluminum paint applied to black polyethylene sheets. Nearby, unprotected plots yielded only 492 squash weighing 289 pounds.

Similar results occurred the following year with some of the same repellent materials. However, the second year, shiny foil applied to paper provided the greatest yield.

Gladiolus flowers protected by the same material produced flower spikes averaging 2 inches taller than those grown in unprotected plots. Only 5 percent of the flowers protected by an aluminum repellent showed the discoloration typical of virus infection; however, 30 percent of the unprotected flowers were diseased. Because of the residual nature of the virus, bulbs from diseased flowers are useless for future production.

Scientists are continuing to experiment with the various types of reflective aluminum, plastic and paper materials against insect pests on other crops. Best results were obtained in both the Beltsville and Farmingdale tests when 50 percent of the ground area was covered. Promising results have also been obtained against thrips and other insects on rose bushes, dahlias, tomatoes, cucumbers and snap beans, but foil surfaces afforded little protection to watermelons with long vines or closely planted chrysanthemums.■

The researchers partly attribute their good results to the fact that the foil covered half the ground area in the squash plots. Aluminum foil alone was stronger and unwound from the roll easier than foil laminated with paper (PN–1761).

Below: *Veterinarian M. J. Van Der Maaten developed the test to differentiate syncytial virus from others (ST–4490–18).* **Right:** *Malmquist (left) and C. A. Manthei, director of N.A.D.L., inspect tissue culture bottle on incubator shelf where virus is grown (ST–4488–9).* **Far right:** *A microtome with diamond blade cuts tissue sample for viewing under electron microscope (BN–33270).*

ON TRIAL

Newly cultured virus suspected agent of leuk

VETERINARY SCIENTISTS, who long suspected a virus to be involved in some way with leukemia of cattle, have finally cultured a virus that looks like a possible candidate.

The common form of cattle leukemia is known as lymphosarcoma. It causes overproduction of white blood corpuscles, which invade body organs, crowding normal cells. In animals that show clinical signs, body processes are slowed and general health declines slowly and steadily until the animals die.

From the way the disease spreads among cattle and the way that affected tissues behave when cultured in the laboratory, scientists have been suspecting for more than a decade that the disease is transmissible and that a virus is the probable agent.

ARS veterinarian W. A. Malmquist of the National Animal Disease Laboratory, Ames, Iowa, started his search by examining giant cells formed in a tissue culture seeded with material from affected lymph nodes and spleen from cattle with leukemia. Giant cells with multiple nuclei are a typical sign of interference with normal tissue growth.

Malmquist ultimately was able to isolate an agent that propagated itself in tissue culture. The agent could be transferred to noninfected tissue cultures, where it continued to propagate.

When the agent was inoculated into specific-pathogen-free calves, all became virus carriers. The calves had been kept from their dams since birth and had been raised in isolation on a synthetic milk formula. So Malmquist says their infection could be attributed with reasonable certainty to the inoculation rather than to transmission from other cattle.

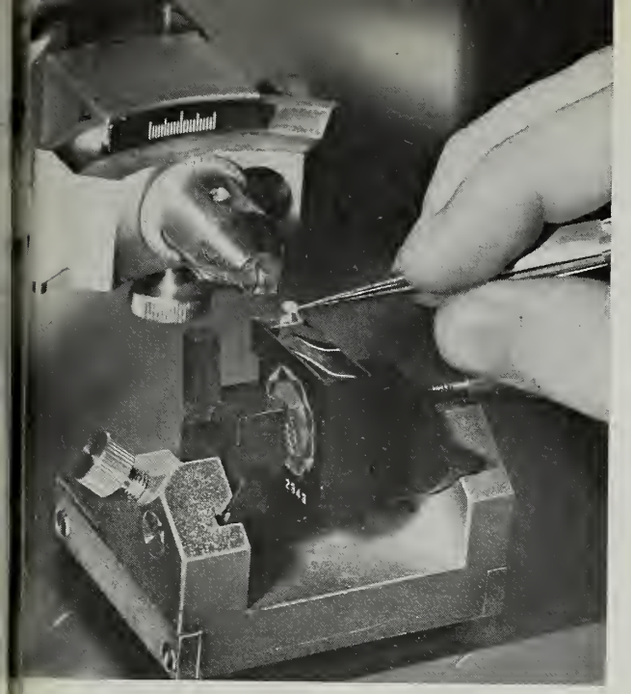
Veterinarian A. D. Boothe examined the giant cells found in tissue culture under the electron microscope, and observed—and later photographed—a virus inside some of them. Its structure and mode of escape from the cell, he says, are reminiscent of known leukemia viruses of chickens, cats, and mice.

Scientists call abnormal masses of protoplasm resulting from merging of cells *syncytia*, and therefore the ARS discovery was named *bovine syncytial virus*. The discoverers regard the virus as a new, separate entity, and veterinarian M. J. Van Der Maaten worked out a special test to differentiate syncytial virus from other viruses.

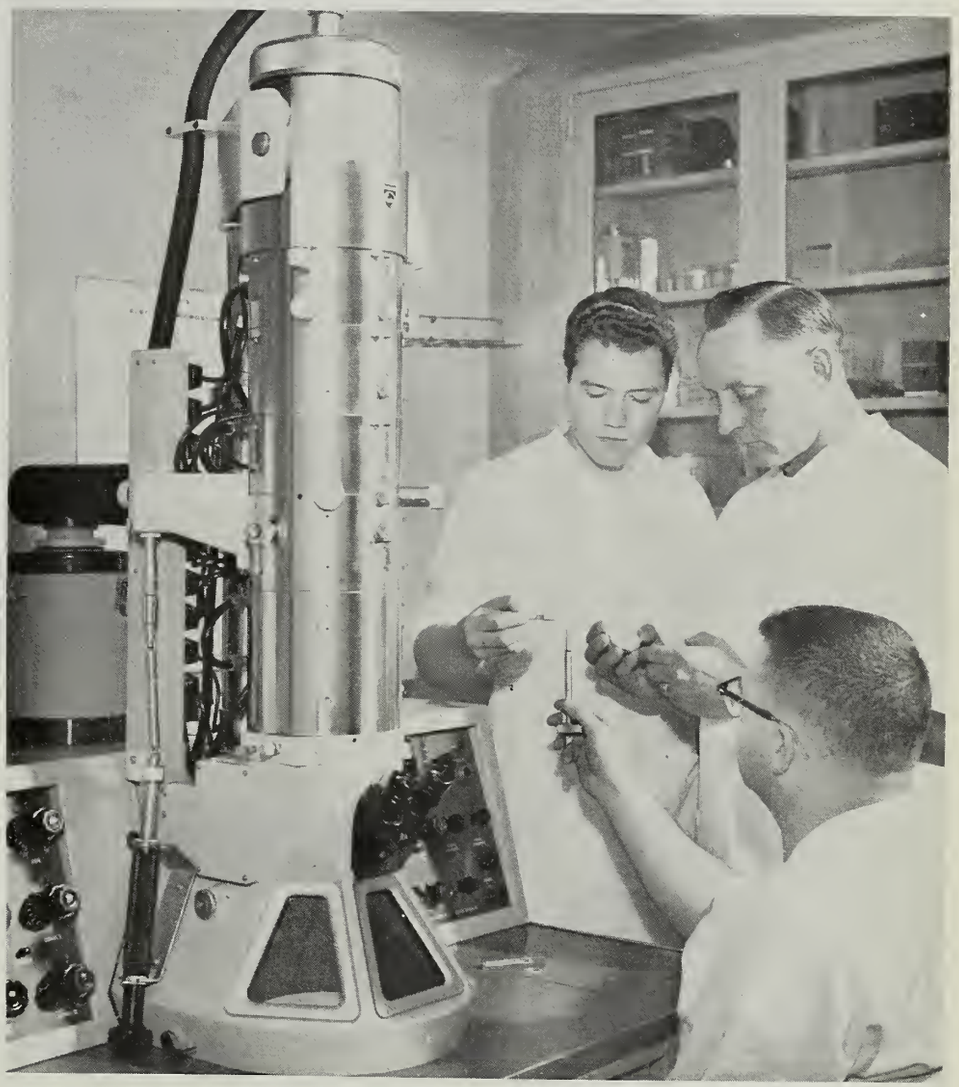
Best available data suggest it will be 3 to 5 years before it can be determined if the calves carrying the virus will come down with the disease; it takes that long for disease symptoms to become obvious. Considerable additional research will go on meanwhile to investigate heredity and other cell factors that influence a complex disease in the leukemia class.

Researchers are encouraged, however, about finding the syncytial virus. Even if it is not the agent of lymphosarcoma they have been seeking, it will still be a formidable factor in explaining the cause and transmission of lymphosarcoma.

Researchers took a preliminary look at how widespread the virus is among cattle. Syncytia-forming viruses showed up in the lymph nodes,



Below top: *Technicians help Boothe load microscope. Technician in center holds dish containing the specimen; Boothe (seated) has the specimen holder of the electron microscope (BN–33269).* **Bottom left:** *Boothe inserts specimen into microscope (ST–4492–2).* **Bottom right:** *Electron micrograph of virus inside syncytial cell. The large oval structure in the center is the cell nucleus which controls cell activity. Most of the metabolic activity occurs in the cell cytoplasm. Viral particles, the black dots at the cytoplasmic membrane, are being released from the cell (BN–33267).*



mia in cattle

spleen, and white blood cells of some known infected cattle submitted to the ARS researchers. These cattle also had antibodies to the virus in the blood. Scientists then examined a control herd that had never shown any obvious symptoms of lymphosarcoma. They found that 20 percent of the cows carried antibodies.

Sample cows in this group selected for further studies carried virus in white blood cells.

Malmquist says that many otherwise normal cattle apparently carry bovine syncytial virus and pass it on to their young—not an unusual situation with this type of virus. Future research will attempt to determine the animal health implications of isolating the virus in "normal" cattle.

Previous research, however, has not shown that the viruses which are involved with leukemia in chickens, cats, and mice are hazardous to other species. Rather, experimental findings in animals have been useful models for pursuing parallel research into human diseases.■

Pig Neighbors
. . . that don't offend

A SEPTIC TANK for hog houses makes feasible the mixing of swine farms and suburban housing without bothering human neighbors with objectionable odors and pesky insects.

The project investigating this issue was far from academic. Purdue University researchers working on contract with ARS found that, like many commercial farmers who once raised pigs far from town, they were being surrounded by ramblers and Cape Cods. And the new neighbors had hardly moved in before they started complaining about the pigs next door.

Swine specialist H. W. Jones, entomologist R. C. Dobson, and agricultural engineer A. C. Dale teamed up at Lafayette, Ind., to see how the pigs could be rehabilitated for urban living.

They built four housing setups. The first was a conventional hog house with fenced lot. Manure and other wastes were washed down a pipe into a 40- by 40-foot manure lagoon.

The second house was insulated, ventilated, and equipped with a concrete floor, except for slots at the rear covering a manure pit. Manure collecting in the pit was pumped automatically into a septic tank. The liquid overflow from the tank also ran into a lagoon.

The third house was much like the second, except that wastes were pumped into a liquid manure spreader and deposited on adjacent farmland. The fourth house also was similar to the second, except that the entire building was built over part of a lagoon. Manure dropped into the lagoon through slots in the floor of the house.

Scientists screened all houses and the single lot, eradicated insects inside, and reintroduced 500 fly pupae into each house to gain a standard infestation. They screened the lagoons at the second and fourth houses, exterminated the mosquitoes, and spread 500 mosquito larvae. The lagoon with the first house was left unscreened and untreated to have a natural mosquito infestation for comparison.

Odor was recorded both subjectively and objectively using standard tests for alkalinity and oxygen content of lagoon water.

The septic tank built into the second housing setup best solved the problems of insects and odor. Flies in the hog house died within 30 days. Only an occasional mosquito was noticed on the lagoon, and the water was not only odorless but even looked fairly clean.

Spreading manure on the field was the second-best alternative. Flies in the house of the third setup also died out within 30 days. There was no pond, and therefore no trouble from pond-bred mosquitoes. Odor was bad, of course, on days manure was spread.

The house built over part of a lagoon was the smelliest. It also had a moderate fly problem, with infestation steady through the summer at about 500 flies. Mosquitoes, however, disappeared from the lagoon for the same reason that the odor was so strong: so little oxygen was available in the water that the larvae suffocated.

The standard house and lot had the expected insect and odor problem. Flies built up numbers rapidly from 500 to 3 million. Mosquitoes on its unscreened lagoon swarmed in great numbers. Odor was stronger than in the second setup, but less pungent than in the fourth.

Scientists regard the successful septic-tank system as a pilot setup. It worked exactly as intended during the summer and never had to be cleaned. But they don't know if extending the use of the setup or doubling pig numbers to the scale of a commercial operation would create problems or excessive costs. Followup research will clarify these points.■

Manure lagoon in foreground is fed from conventional hog facility at left with screen over house and lot. The other two houses used pits for manure disposal. The one in center was connected to a septic tank and lagoon (PN–1762).

Left: *Technician G. L. Eberle collects milk sample for white blood cell counts (ST–329–26).*
Above: *Technician S. L. Womack prepares the milk sample for testing (ST–328–16).*

better method for BULK MILK Testing

QUALITY OF MILK in the store will be monitored more precisely, thanks to tests devised with the help of ARS scientists.

The tests will allow regulatory authorities to estimate the level of white blood cells in bulk milk more reliably. High white blood cell numbers are interpreted as a body response to mastitis infection.

A dozen or so mastitis screening tests now in use estimate white blood cell levels but, unfortunately, each one contains quirks. Thus the tests frequently disagree with each other and with direct counts of white cells made by microscope, resulting in controversies about milk unfairly condemned or improperly evaluated.

In tests at Beltsville, Md., for example, ARS dairy scientists W. D. Schultze and J. W. Smith showed that the California Mastitis Test registered cell levels too high in 38 percent of the samples, and too low in another 10 percent when compared with direct microscope counts. But even this evaluation could not be applied practically by all laboratories because there has been little agreement on procedures for making direct cell counts.

The National Mastitis Council sponsored a nationwide project to develop a uniform microscope procedure. The basic approach in such a procedure is to place a measured drop of milk on a glass slide and dry it to a film. In counting the white cells in the film, an analyst formerly worked out his own system for selecting areas on the film to examine.

As part of ARS' contribution to the Mastitis Council's project, Schultze designed a specially etched eye piece for microscopes that guides the analyst to standard, precisely defined areas on the milk film. This lessens the work of the analyst but increases the area of film examined per analysis, thus increasing precision of the result. Smith contributed a statistical method to determine—and even control to some extent—the level of precision of the final estimate.

Uniform application of the Council's suggestions is likely, since the Interstate Milk Shippers Association agreed with the U.S. Public Health Service to define acceptable milk as having no more than 1½ million white blood cells per milliliter. According to a stage of enforcement that went into effect July 1, 1968, milk producers exceeding this limit may not continue to supply milk for interstate shipment until they again comply with the limit.

The new procedures can be applied to this current legal limit or any other cell count level ever selected as appropriate for identifying a mastitis problem on the farm. At the same time, any such limit will protect the consumer by helping provide milk that meets up-to-date standards of quality.■

Left: *Technicians examine bud-cut carnations after they have fully opened (PN–1763).* Right: *Bud-cut carnations partially opened, that is, showing one-half inch of color, are readied for packing (PN–1764).*

BUD-CUT CARNATIONS ...nip shipping costs

A NEW CARNATION marketing system being tested by ARS could mean substantial savings to flower growers and transporters.

ARS scientists are finding that cutting, shipping, and storing carnations as buds instead of in full bloom, the usual practice, can lower marketing costs without adversely affecting flower appearance. The buds are later opened with chemically fortified vase water.

As of February 5, 1969, three commercial florists were receiving ARS test shipments of bud-cut carnations by air from Colorado. ARS transportation engineer R. F. Guilfoy, Hyattsville, Md., estimates that if bud-cutting is widely adopted, savings in distribution costs for air shipments of carnations out of California and Colorado alone would come to about $1 million a year. These two States supply 69 percent of the carnations sold in this country.

In the shipping tests, carnations from a commercial greenhouse in Colorado are cut when ¾ to 1 inch of color shows on the buds. Indications are that cutting and bunching is faster and more economical with buds than with open blooms.

Guilfoy found that as many as 600 buds will fit in a fiberboard shipping box that normally holds only about 225 open blooms. Yet, the box filled with buds weighs only about twice as much as the box filled with open flowers. Thus, bud-cutting can save transporters money on both shipping space and weight.

ARS horticulturist R. E. Hardenburg, Beltsville, Md., found that buds can be stored after shipment for 1 week at 40° F., or up to 3 weeks at 33°. Bud-cut carnations can be held and opened to full bloom as needed—perhaps to help meet extra weekend and holiday demands.

To open and preserve the buds satisfactorily after storage, the wholesaler or retailer must use a chemical preservative. Hardenburg found that buds placed in a preservative (such as "Cornell" solution containing 5 percent sucrose, 200 ppm 8-hydroxyquinoline sulfate, and 50 ppm silver acetate) will open to a diameter of 2¼ to 3 inches in 1 to 3 days at 70–75° F.

Carnations maintained in this preservative will last about twice as long—10 to 14 days—as flowers kept in water and will continue to grow until the blooms reach a diameter of 3½ to 4 inches.

Differences in flower variety or season of cutting do not seem to affect the performance of bud-cut carnations.

Results of the ARS shipping and marketing tests confirm those of earlier experiments by W. D. Holley of Colorado State University, Fort Collins, and H. C. Kohl, Jr., of the University of California, Davis, who demonstrated that carnations can be successfully opened after cutting in the bud stage.

ARS horticulturist F. J. Marousky stationed at Bradenton, Fla., is now testing the ability of bud-cut chrysanthemums to open to full bloom when placed in a preservative. The researchers plan shipping and storage experiments with chrysanthemums similar to those being conducted with the carnations.■

SOPHISTICATED adulteration increases the problems of selling U.S. citrus juices abroad and occasionally in the highly competitive domestic market.

But an ARS-sponsored Public Law 480 project in Spain has substantially helped the citrus industry in its search for rapid, accurate methods for detecting adulterated juices.

Horticulturist A. L. Ryall, ARS sponsoring scientist, says that additives such as synthetic coloring matter, peel carotenoids, commercial citric acid, and saccharose (cane or beet sugar) can be made into mixtures that do not alter the balance of major components in the original juice. For this reason, the unmasking of sophisticated adulterations requires a broad knowledge of the composition of natural juices and of the impurities present in the additives.

Spanish investigators conducted a 5-year research project on citrus juice components including carboxylic acids, sugars, amino acids, carotenoids (pro-vitamin A pigments), flavonoids (flavor pigments), and mineral elements (minor components).

In comparing differences in the strength of citric acid and sugar in pure orange juice and in adulterated orange juices, the Spaniards found that the ratio of acidity to the quantity of neutralizing chemical permits the detection of commercial citric acid where adulteration is more than 35 percent.

Other investigations showed that adulterating orange juice with cane or beet sugar obviously modifies the high correlation between the acidity and the sugar-acid ratio, a maturity index of the fruit.

From the studies of amino acids in pure juices and those present as impurities in adulterated juices, the researchers developed chromatograms, which are chemically produced color pictures, that clearly plotted the differences in the peaks made by the natural juices and those produced by the additives.

Chromatograms also served to detect peel carotenoids used as adulterants in natural juices. Two spots that are not found on the chromatograms of natural juices, for example, were present in those of peel-adulterated juices.

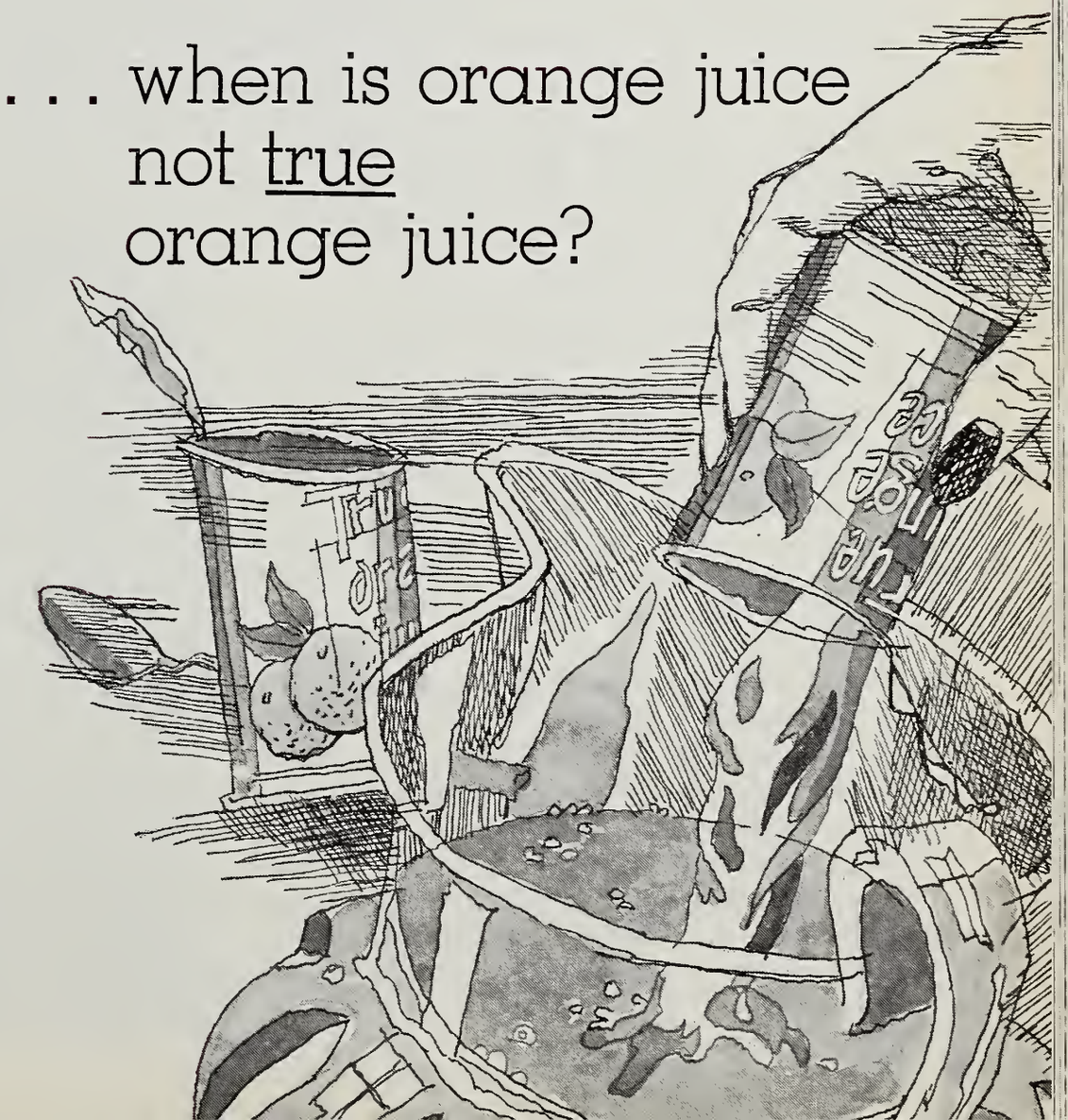
Similar methods were adapted to isolate and determine the amounts of flavonoids and mineral constituents in natural and impure juices. Minerals such as phosphorus, potassium, and combined calcium and magnesium—which occur in minute quantities—were particularly sensitive indicators of adulteration.

Besides detailed composition data, the Spanish study developed rapid methods for analyzing significant components accurately.

In noting the high correlation between acidity and maturity, for example, the Spaniards found the index of maturity could be deduced directly from acid content without measuring sugar concentration. Ordinarily, maturity index has to be calculated on a sugar/acid ratio.

And in analyzing sugars, they eliminated the time-consuming steps of first sorting out the acids and amino groups which accompany the sugars. The same systematic procedures were applied to the analyses of lemon juices with comparable results.

This work, directed by biochemist E. Primo, was conducted at the Institute of Agricultural Chemistry and Nutrition Technology, Valencia.■



Cotton Textile Processing

. . . someday computers and pushbuttons

ARS SCIENTISTS are blending a little "scientific dreaming" and a good bit of fundamental information in early efforts to develop a completely new cotton textile processing system.

Although the system currently employed represents more than 200 years of machinery evolution, it is costly and the basic design unchanged since the 18th century. An efficient cotton mill, for example, produces about 160,000 pounds of print cloth per 100-hour week with an estimated labor force of 250. In contrast, the same amount of paper, which successfully competes with cotton in an increasing number of uses, can be produced by about 35 operators in a 100-hour week at a streamlined plant.

To meet the problem, the ARS Southern utilization research laboratory, New Orleans, La., reoriented its textile machinery research several years ago toward studies in ultrasonics, aerodynamics and electrostatics as possible means of manipulating cotton fibers.

The research group claims only a modest beginning, but a number of promising leads have been found, say physicist R. A. Rusca and engineer Mayer Mayer, Jr.

- A comprehensive study of the effects of sonic energy on cotton indicates the possibility of using sonic forces to create nonwoven materials directly from cotton fibers.
- Aerodynamic studies suggest that specially shaped ducting may possibly be employed to classify cotton tufts and to separate trash from lint.
- The dilation effect—creation of an air flow by alternately pressurizing and suddenly depressurizing a special chamber—may prove important in opening and fluffing baled cotton. The scientists have employed this means to fluff small amounts of tightly packed cotton and they belicve it has potential for use on a large, multibale scale.
- Rapid velocity changes in air flow may one day serve to aline or parallelize cotton fibers to replace carding, a wasteful, low-speed but essential mechanical procedure in the present system.

The most advanced of the basic studies is in electrostatics, where the new knowledge gained has already resulted in a laboratory device to separate short, unspinnable fibers from the spinnable fibers. In the experimental device, an electrical field between revolving cylinders causes the individual fibers to stand erect. The long fibers can then be separated for further processing and the short fibers removed as waste in a continuous operation.

The implications of this unit go far beyond the removal of short fibers. Because cotton from the bale could be fed in and a textile strand withdrawn, the unit may one day help to eliminate all conventional opening, cleaning, carding, and drawing machinery. This would be a gigantic step toward a truly continuous cotton processing system.

Based on studies to date, Rusca and Mayer find it easy to "conjure up" a fundamentally new system—a pushbutton mill involving a computer selection of bales that would be automatically conveyed to a large aerodynamic chamber. From there, uniform tufts would be moved by air through special ducts, where they would be separated into individual fibers, then to parallel banks of black boxes. With the aid of aerodynamic and electrostatic forces within the black boxes, the trash would be removed and the fibers alined and formed into uniform yarns ready for weaving.■

Researcher checks roller speed of the experimental fiber separator's feed mechanism (PN–1765).

AGRISEARCH NOTES

Herbicides Practical for Yew, Maple

Herbicides, as alternatives to mechanical cultivation and hand weeding, promise greater economy and more efficiency for commercial growers of woody ornamental nursery plants.

Each year, control of weeds such as crabgrass, bermudagrass, lambsquarters, johnsongrass, chickweed, and purslane cost U.S. commercial growers more than $33 million.

ARS plant physiologist L. L. Danielson and ARS horticulturist Curtis May tested the efficiency of several herbicides on two ornamental species—Hicks yew and Japanese maple. They made repeated applications of DCPA, chlorpropham, trifluralin, dinoseb, and amitrole to the soil for 3 years.

Each of the commercially-available herbicides effectively controlled weeds and caused no injury to the yews or maples.

Long Days Permit Cane Crosses

By extending photoperiods to delay flowering, scientists in Florida can intercross early-, mid-, and late-flowering sugarcane plants.

Sugarcane crosses, vital in developing improved varieties, had been impossible at the U.S. Sugarcane Experiment Station, Canal Point, Fla., because of this plant's different flowering times. Early-flowering sugarcane completed flowering by the first part of December, mid-season sugarcane

Lighting equipment used to extend the photoperiod and thus delay sugarcane flowering is lined up over crop row (PN–1766).

finished flowering by January, and late-flowering cane began flowering in January and finished as late as March.

In the Canal Point experiments, ARS agronomist N. I. James subjected early- and mid-season flowering clones to photoperiods of 12.5 hours for 2, 4, and 6 weeks to delay flowering. Delays, ranging from 10 to 72 days, were enough to permit crossing of early-flowering clones with all mid-season clones. Also, mid-season flowering clones could be crossed with many late-flowering clones.

Besides delaying the flowering of sugarcane, extended photoperiods also greatly improve pollen production and fertility rates, which increase the number of seedlings.

Fiber Sorter Fast and Efficient

An ARS-designed instrument determines the proportion of short and long fibers in ginned cotton lint four to five times faster than available commercial equipment.

The experimental Mesilla Park fiber sorter should be useful in research and in the cotton textile industry, which needs information on fiber lengths in estimating the spinning performance of ginned lint. Excessive amounts of short fibers (one-half inch or shorter) are detrimental to spinning performance. The percentage of short fibers in lint can be affected by environmental conditions during growth as well as by ginning practices.

The Mesilla Park sorter, developed by ARS cotton technologist W. E. Chapman, removes in sequence long, intermediate and short fibers. It is not yet commercially available.

Chapman says the Mesilla Park sorter and the commercial instrument in use performed comparably in measuring short and long fibers. But the operation of the commercial sorter is tedious and time-consuming. He compared performance of the sorters on California and Arizona upland and New Mexico pima cottons.

Chapman's research at the Southwestern Cotton Ginning Research Laboratory, Mesilla Park, N. Mex., also showed similar relationships between short-fiber measurements by the two instruments and various spinning properties and yarn qualities.

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AGRISEARCH NOTES

Cut Dosage Still Degreens Citrus

Ripe green oranges are just as sweet and juicy as sunny-colored ones. But even knowing this, you probably won't want to buy green oranges for tomorrow's breakfast juice or lunch-box snack.

To assure that the fruit reaches an acceptable color while it is at its tasty and nutritious peak, warehousemen hasten natural degreening—removal of chlorophyll from the rind—by exposing freshly picked green citrus to ethylene gas. However, present procedures may not produce the best results.

Realizing that a long exposure to excessive or inadequate levels of ethylene, at too high a temperature, can promote fruit decay as well as be uneconomical, ARS scientists are reevaluating the effects of various degreening practices.

Horticulturists O. L. Jahn and W. G. Chace, Jr., and technician R. H. Cubbedge, Orlando, Fla., found that 1 or 2 days exposure to a low concentration of ethylene—5 to 10 parts per million in the treatment atmosphere—stimulates rapid degreening in Hamlin oranges. Warehousemen frequently expose citrus to as much as 200 ppm or as little as 1 ppm ethylene for up to 3 days.

In these tests, degreening continued after ethylene treatment while the fruit was held for about a week at 70° F. This holding period simulates the time required for fruit to move through marketing channels.

The scientists also found that ethylene-treated Dancy tangerines degreened at 85° and 70° had comparable chlorophyll levels 4 days after treatment. Keeping degreening room temperatures as high as 85°, as is usually done, may therefore be unnecessary.

According to their research, the long-term degreening effects of low (10 percent) and high (50 percent) oxygen levels with ethylene were not significantly different from the effects of ethylene in air (21 percent oxygen). These results indicate that ventilation during degreening may not be as important as is generally believed and that expensive equipment to raise the oxygen level would not be justified by improved degreening.

Relative humidity during these tests was 95–100 percent.

Erosion Does Follow Soybeans

Land in a 2-year rotation of corn and soybeans lost more soil by erosion than land in continuous corn in Iowa tests, and the heavy erosion occurred the year following the soybeans.

For many years farmers have noticed that the soil seemed looser following soybeans than corn. This looseness made the soil more susceptible to wind and water erosion. Yet, many soybean producers doubted that erosion was greater under the soybeans.

To find some answers, ARS scientists measured erosion in three crop sequences—corn following soybeans, corn following corn, and soybeans following corn. The Iowa Agriculture and Home Economics Experiment Station, Ames, cooperated.

During a 5-year period (1963–67), the average annual soil loss from four plots in soybeans following corn just equaled that from continuous corn. Soil loss from corn following soybeans was 40 percent greater than after continuous corn.

During the first and second months after seeding, runoff from corn following soybeans averaged 18 percent higher and soil loss 25 percent higher than from continuous corn. Losses represented about 75 percent of the annual soil loss, although only about 36 percent of the erosive rainfall occurred during the period.

ARS soil scientists W. C. Moldenhauer, Ames, Iowa, and research statistician W. H. Wischmeier, Lafayette, Ind., suggest that corn be planted in the soybean residue without tillage to reduce the erosion hazard.

CAUTION: In using pesticides discussed in this publication, follow directions and heed precautions on pesticide labels. Be particularly careful where there is danger to wildlife or possible contamination of water supplies.

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